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A. C. True, Director.

IRRIGATION FROM SNAKE RIVER, IDAHO.

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The territory discussed in this report lies along the Snake River from St. Anthony, near the eastern line of Idaho, down to where Salmon River enters from the south, a distance of about 200 miles, and embraces approximately that part of the Snake River plains which was in geologic times covered with lava. While this prehistoric lava bed has a total area of about 12,000 square miles, the amount of land which can ever be farmed under irrigation is limited to certain tracts comparatively free from outcropping lava rock and conveniently situated for gravity irrigation from Snake River or its tributaries.

The report of surveys made in 1904 for the State engineer as the basis for water-right decrees shows an irrigated area of 290,700 acres, and an additional irrigable area (under ditch) of 502,500 acres, in the valley as far down as Raft River. Below this point are 240,000 acres of new land under the main Twin Falls Canal, and the completion of the north side Twin Falls Canal will add 30,000 acres more. The north side canal of the Minidoka reclamation project is under construction, and will cover about 60,000 acres, and a canal is proposed on the south side to irrigate 60,000 acres more. If to these large areas of new land is added the Dubois reclamation project, which is proposed for the irrigation of 200,000 acres southwest of St. Anthony, with water to be stored at the head of Snake River, we have a grand total of over a million acres of new land, nearly every acre of which will have to be cleared, fenced, smoothed, and prepared for irrigation in the next few years. Of this area 800,000 acres, including the north side Minidoka tract, is actually under ditch to-day.

With many local differences these lands are alike covered more or less heavily with sagebrush. The fine, yellow-white, wind-deposited soil, underlaid by porous strata of lava, varies in thickness from nothing to 40 feet, but is so generally alike in texture and quality that similar methods of preparing land for irrigation apply to the entire

basin. It contains all the chemical constituents necessary for plant growth, and is especially rich in lime. The prevailing winds are from the southwest, and the soil is found to be exceedingly deep on the northeastern slopes of knolls, while lava rock generally outcrops on the southwestern slopes. Analyses of samples of soil taken from different depths show practically the same chemical constituents throughout, except that a small amount of humus is found in the first 6 inches. Both black and white alkali are found, but in rather small amounts. The soil is exceedingly light and fine, and except in creek bottoms is almost entirely devoid of coarse sand. Though the virgin soil is lacking in humus, some exceptionally good crops have been raised, and once it is properly fertilized with leguminous crops the yields should be heavy.

The somewhat rolling character of the Snake River plains and the porous character of the underlying lava rock are its best safeguards against the rise of alkali in the future, and this advantage goes far to offset the greater hardship in leveling the land and getting it into shape for irrigation. On the Twin Falls and Minidoka tracts nearly every quarter section has its own drainage channel, and all excess alkali is carried through it to the Snake River, without being deposited on the land lying below. The high duty of water usually assumed in selling water rights will tend to prevent excessive irrigation, and this, with the natural drainage conditions, assures the complete immunity of the tracts from injurious alkali.

OBTAINING LAND AND WATER.

Of over 250 canals and ditches described in the State engineer's survey of the sixth judicial district only 23 are reported as having no "additional acres irrigable," all the rest having unimproved lands under them. A few of these ditches are organized as irrigation districts, and many are cooperative or incorporated canals, the price of land and cost of rental of water varying too much to be described here. It may be said, however, that there is a strong tendency toward the ownership and management of canals by users rather than by outside corporations. The Carey and reclamation acts and the irrigation district law all provide for the ultimate control by users.

Under Carey act enterprises the price of water rights is limited by the contract made with the State by the construction company. The American Falls Canal, built under this act, is to irrigate 90,000 acres, water rights for one-eightieth cubic foot per second per acre on the main canal, or one-fiftieth cubic foot per second on laterals, being sold for $15, $20, and $25, according to location, to be paid in installments, with 6 per cent interest, running eight years. No provision is made for an annual maintenance fee. State lands are sold under special rules. Under Marysville Canal, also built under the Carey act, in the

northeastern part of Snake River plains, there are 18,500 acres, of which 14,000 acres are unimproved. Water rights are sold for not to exceed $10 per acre, payable in installments running five years, the duty assumed being one-eightieth cubic foot per second per acre. The annual maintenance fee is 20 cents per acre.

Under Twin Falls Canal, another Carey act project, water rights are sold for $25 per acre, entitling the holder to a continuous flow of 1 cubic foot per second for each 80 acres. As under all Carey act enterprises, the State charges 50 cents per acre for the land, making the first cost $25.50 per acre. One-half the price of the land is payable when filing the claim, and the remainder when making final proof. Payments for water rights cover a period of ten years, $3 per acre payable in cash, with interest at 6 per cent on deferred payments. A maintenance fee not to exceed 80 cents per acre per year is charged to meet operating expenses. Land can be filed on by an agent, and it is not necessary to be a citizen of the State to make entry. Residence on the land is not necessary until the canal company notifies the settler that the water is ready for delivery, after which the settler must live upon and cultivate his land. Final proof must be made within three years of the date of notification that the water is ready for delivery. In order to complete the title one-eighth of the land must be under cultivation. A filing may be transferred from one person to another, and final proof made by the latter. At the time of final proof the settler must show that he is a citizen of the United States, 21 years of age; that he has cultivated and reclaimed one-eighth of the land, and that he is a settler on it, and pay the remaining 25 cents per acre of the price of the land, after which the land is conveyed to him by the State. A water right carries the ownership of a proportionate share in the entire system, and when the works are completed and water rights paid for the management of the works will be turned over to the settlers.

The price of water rights under the reclamation act project at Minidoka, above Twin Falls tract, has not been fixed as yet, but, according to an estimate in the report of the Secretary of the Interior for 1905, will be $22 or more per acre, payable in ten annual installments, without interest, according to rules laid down by the Department of the Interior. Lands are obtainable only under homestead entry on payment of usual land office fees, but the commutation clause of the homestead act does not apply, and filings may be made only on contracting to pay for water rights.

CONDITIONS UNDER A NEW CANAL.

The details of irrigation during the early years of new projects are of great importance to the new settler, especially to those who come from humid regions, and find many entirely new problems. As the

opening of Twin Falls Canal offered a chance to observe first-year conditions on a very large tract, the writer was sent there in the summer of 1905 to collect such information as might prove useful to settlers on this and other tracts.

The Twin Falls project includes two canals, one on either side of Snake River, the head gates for both being located at Milner. The main canal on the south bank of the river is partially completed, but no work has been done on the north side canal. For 10 miles below Milner the hills border closely along the canyon, but near Murtaugh, 10 miles west of Milner, the hills and river diverge sharply, the canal swinging back gradually from the canyon and then running at a distance of not less than 6 miles from the river to the banks of Salmon Creek, 65 miles from Milner. About 35 miles west of Milner the canal forks, there being a drop of 14 feet from the main to what is known as the low-line canal, the main canal continuing as the high line. Both branches end at Salmon Creek Canyon.

The country through which the canal flows is rolling, being crossed by a great number of small valleys, or coulees, which carry the surface water into the Snake River, and is characteristic of the Snake River plains. Wherever possible, the canal has been constructed so as to intercept the flow from these coulees, increasing the amount taken in at the head gate by that drained from an extensive territory. These coulees are also used as main distributing laterals. A short ditch connects the main canal with some convenient coulee down which the water runs to the point for distribution, where a small check dam rediverts the water into sublaterals. In this way the cost of a great amount of ditching is saved and the number of farms cut up by laterals reduced. A heavy loss of water occurs in the coulees, the slope being so steep, as a rule, that the channel can not silt up, allowing the water to seep through crevices in the lava rock. Portions of the canal now in use are in an unfinished condition, and during the winter months the company intends working over the entire length in use, finishing the rock cuts and strengthening the banks wherever necessary.

Water was turned into the canal early in 1905, somewhat in advance of the time set by the officers of the canal company, in order to aid the settlers in harvesting a crop the first year. In some portions of the tract water was not delivered until June, while nearer the head gate water was available several months earlier.

No attempt was made during 1905 to restrict the settlers to the quantity of water called for in the contract. Since the water was turned on the canal has carried sufficient water to irrigate about ten times the area of land under cultivation, and farmers have been allowed to use water in as large quantities and as often as they liked. All the waste gates have been opened and water is poured onto the land where-

ever possible, the idea being to saturate the ground as much as possible before the demand for water equals the amount appropriated. The soil is so exceedingly dry that it would require a great deal more water than has been appropriated to irrigate the tract during the first few years, provided the entire acreage were under cultivation, but settlement is gradual and the older portions of the tract will be saturated sufficiently to be held to the water right paid for by the time the newer portions come under cultivation, while the excess can be used in saturating the newer parts.

SEEPAGE LOSSES IN NEW CHANNELS.

Measurements were taken to determine the seepage loss on a portion of the main canal, 8 miles in length, through a tract where the soil was deep and where the losses represent the average to be expected throughout the entire length of the canal in the future, after the rock cuts have been silted up. The total amount of water flowing in the canal at the upper end of the section measured was 900 cubic feet per second, while the measured outflow was 836 cubic feet per second, showing a loss of 64 cubic feet per second in 8 miles, or 8 cubic feet per second per mile.

Two laterals were also measured, one built on the usual grade used for laterals in the system, while the other was on a grade twice as steep. In the first lateral the amount flowing at the head gate was 5.05 cubic feet per second, and the outflow 4.8 cubic feet per second, making a total loss of 0.25 cubic foot per second in slightly over 2 miles. The second lateral carried 24.8 cubic feet per second at the head gate, and the outflow in 1 mile was 19.2 cubic feet per second, making a loss of 5.6 cubic feet per second per mile. The greater loss per mile in the second lateral was without doubt due to the greater velocity of the water, which prevented a deposit of silt, thus keeping the channel from becoming watertight. The evaporation loss during the summer months is exceedingly heavy, measuring 4 inches in ten days from a tank set in a running ditch.

EXPENSE TO NEW SETTLERS.

As already explained, the first cost of land and water right, assuming that the settler pays the entire amount in one payment, is $25.50 per acre. To the first cost must be added the cost of fencing, grubbing sagebrush, plowing, grading, marking, ditching, seeding, and irrigating.

Fencing.—Fence posts cost about 13 cents each delivered at Twin Falls. About 320 posts are required to fence 40 acres, where roads or lanes are laid out every half mile, making the cost per acre for posts about $1. The additional cost depends upon the kind of wire used

and number of wires strung; but the average total cost for barb-wire fence is close to $3 per acre.

Clearing.—The entire tract is covered with sagebrush, varying in height from 2 to 6 feet, which must be cleared off before any plowing or leveling can be done. Most of the settlers clear land by hand, cutting down the brush with an ordinary mattock, and piling and burning it. The cutting and piling is generally done during the day, and the burning at night. One man can clear an acre of land in two days, cutting in one day as much as he can pile and burn the next. With a sharp mattock the brush can be cut easily a few inches below the surface of the ground. The older residents of southern Idaho claim that about an acre a day can be cleared by one man when the ground is frozen, the brush being held firmly by the frozen soil, which prevents its yielding when struck by the mattock. When the brush is dry the land is sometimes cleared by burning it as it stands. By this method one man can easily clear an acre a day. It is claimed that this leaves the soil in better condition than before, the roots burning down into the ground leaving the ash as a fertilizer. Contracts for clearing land by hand, which include the piling and burning of the brush, have been made for an average of $3.50 per acre, the price depending on the market price for day laborers.

When the land is not cleared by hand three different methods are used in grubbing out the brush. Probably the cheapest of the three methods is to draw a railroad rail back and forth over the land. With 6 horses hitched to an 18-foot rail 22 acres were cleared in three days, three hands being employed. The rail was dragged over the brush twice, in opposite directions, and then followed up with the grubbing hoe. The actual cost by this method, at the time when wages, board, and horse feed were very high, was about $3 an acre.

A considerable area has been cleared with a grubber consisting of a knife edge carried on a wheel base and drawn about 6 inches below the surface of the ground. About 4 acres a day can be cut by this grubber. Though in use only a short time it has given very good results.

Sometimes the sagebrush is piled in heaps by hand preparatory to burning, but generally it is raked into windrows with an ordinary hay rake or some form of homemade rake. While most of the settlers burn the brush as fast as it is cut, quite a number stack it for fuel. Sagebrush burns readily and leaves a good bed of coals, making it an excellent fuel for household use. With coal at its present price in southern Idaho, a stack of sagebrush is a valuable asset, and will help materially in cutting down a farmer's expenses at a time when the outlay for getting new land in shape is especially heavy.

Plowing.—Settlers frequently do not bring all their farming implements with them and consequently must have their plowing done by

outside parties. A contract for plowing generally calls for a depth of 6 inches, but a number of fields have been plowed only 4 inches. The cost for plowing 6 inches is between $2 and $2.50 an acre, which does not include the cost of harrowing. The cost of putting in seed is about 50 cents an acre.

A number of farmers, acting on the advice of older settlers, have disked their land instead of plowing it. A comparison of the crops grown on the disked and plowed land shows clearly the advantage of deep plowing. This was best shown on the experiment farm, at Twin Falls, where two fields were sown with alfalfa, both having been prepared for crops in exactly the same manner except that one had been plowed 6 inches deep while the other had been disked to a depth of 3 inches. At the end of four months the alfalfa in the plowed field stood 12 inches high while that in the disked field was only 3 inches high. Deep plowing turns under the humus in the top layer of soil where the plants' roots can feed upon it, helps the water to percolate more freely by loosening the soil to a greater depth, and destroys the larvæ of injurious insects by exposing them to light and air.

Grading.—Land is generally leveled with a drag made of a few boards weighted with iron or large stone, the soil after plowing and harrowing being loose enough to work readily into shape. In their haste to satisfy the requirements for proving up many of the settlers have done no more leveling than was absolutely necessary, causing almost endless trouble when the water is turned over the land. As a result, a number of farms are cut by gullies and crops have been washed out by the water when beyond control. Even where the land is not badly washed the yields are uneven, owing to the fact that the lower portions receive too much water while the knolls receive barely enough to mature the crop. Where the leveling has been properly done, the yields have been even, and the soil has not been cut by unmanageable streams. The importance of leveling the land can not be too greatly emphasized. For a uniform yield it is essential, not to speak of the added ease in irrigation and the saving in the length of laterals required. The average cost for leveling has been about $1 per acre. This unavoidable disturbance of the upper layer of soil, which contains more or less humus, tends to make the crop uneven the first year or two, but will not cause any lasting injury. Uneven irrigation is a much more serious detriment.

Marking.—The cost of marking the furrows which act as ditches in carrying the water over the field is generally included in the contract for clearing, plowing, and leveling. After the land has been plowed and cleared, the furrows are quickly and easily made by some form of marker, such as the one shown in the sketch (fig. 1). A combined

marker and roller in use on one farm gave very good results, correcting the smaller irregularities in the surface at the same time. The furrows, except where the grade is too steep, are generally run in the direction of greatest slope.

Ditching.—The amount of ditching required depends on the distance of the farm from the main lateral and the character of the ground surface. Where conditions favor, ditching has cost as low as

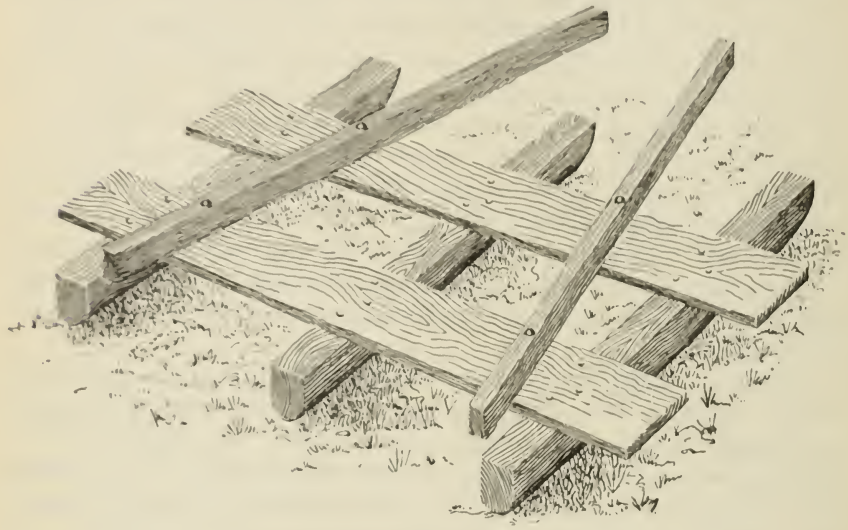

FIG. 1.—Marker for irrigation furrows.

$1 per acre. It has cost as high as $5 per acre, averaging between $2 and $3.

Irrigating.—Contracts for applying water have been made for $2 per acre for the season. The contract usually calls for three or four irrigations, any above that number being paid for extra.

Total cost.—The various items of cost per acre may be summarized as follows:

Statement of cost per acre for first year.

First cost of the land and water right	$25.50
Fencing material	3.00
Labor:	
Grubbing sagebrush	3.50
Plowing	2.50
Seeding	.50
Leveling and marking	1.00
Ditching	2.00
Irrigating	2.00
Total cost per acre	40.00

In case the settler uses his own teams and labor for clearing, leveling, plowing, etc., and meets the payments on his land as they fall due, the cash outlay per acre for the first year will be as follows:

First payment on water right	$3.00
First payment on land	.25
Fencing material	3.00
Total	6.25

METHOD OF IRRIGATING.

The furrow system has been generally adopted by the farmers on the Twin Falls tract for all crops now raised. In irrigating by this method water is carried through the bank of the main lateral in a box about 4 inches square and 18 inches long, made of 1-inch stuff. From this box the water is led into the furrows or corrugations made by the marker, four to eight furrows being supplied from one box. The furrows are spaced 2½ feet apart, are about 3 inches wide, and 2 inches deep, and vary in length from 300 to 800 feet, depending on the grade.

Enough water is turned through each box in the head ditch to supply each of the furrows under it with a small steady stream. Too much water makes the soil wash, while if too little is used the water will not reach the lower end of the furrows. About the proper amount will run the length of a 500-foot furrow in three hours. The water seeps laterally between the furrows and is left running until the moisture meets in the center throughout this length. This requires twelve to eighteen hours, and in that time the soil is saturated to a depth of 4 to 6 feet. After the ground has been irrigated a few times the furrows become more permanent, and when the proper amount of water is turned into the head ditch the field does not require any further attention until the irrigation is complete.

In the older irrigated districts of southern Idaho it has been found that a heavy irrigation in the fall is of more benefit than the lighter irrigations given during the growing season. Besides furnishing a reservoir of moisture when the plants are young and need it most, such an irrigation also shows any variations in the ground surface, which can then be corrected before the crop is planted.

As a rule, the new irrigators have tried to use furrows which were too long. The result has been too much water at the upper end of the field and too little at the lower end. The best plan is to have short furrows, gather up the waste water at their ends by waste ditches, and redistribute it or carry it over to some other field where it is run over a new set of furrows. For cultivated crops the best length is 250 to 400 feet. With furrows of this length little water will waste at the lower end of the farm and crops will be more evenly watered.

During the summer months the desert soil is almost devoid of moisture, and a larger amount of water is required for the first irrigation

than for any subsequent ones. In order to determine the amount of water required per acre to saturate the soil sufficiently to start plant growth, an experiment was conducted on a tract west of the town of Twin Falls, under the direction of Mr. A. McPherson. This land was prepared by the same methods used on most of the other farms on the tract. The brush was "railed," stacked, and burned, after which the land was plowed 6 inches deep and harrowed once with a disk harrow. Some leveling was done, but not enough to put the land in good shape for irrigation. An alfalfa crop was seeded and the furrows marked in the direction in which the water was expected to flow. A recording device was installed on the head ditch to measure the amount of water turned over the farm, while a similar device was placed at the lower end to determine the amount of waste water. The difference shows the amount of water absorbed by the land and lost by evaporation. A head of water sufficient to supply six or eight boxes at a time was turned into the head ditch, supplying between fifty and sixty furrows. Most of the first day was spent in repairing leaks in the head ditch and in diking up some of the furrows to force the water across the low places. The soil was so exceedingly light that it required the constant efforts of two men to keep about a hundred yards of head ditch in good order, but after the first day the soil had settled to such an extent that the ditch gave no further trouble. When the water was first turned into the furrows, the sagebrush débris completely stopped up some of the small boxes, requiring constant attention to keep these cleared and establish a uniform flow. Where the land had a regular slope, the water flowed through the furrows very steadily and with no washing, but where the field had been crossed by a dead furrow and a small gully which had not been filled up when the leveling was done, the water spread in pools and cut across from one furrow to another, requiring a great deal more labor to irrigate a small portion of the field than it would have taken to grade the entire tract properly in the first place. The difficulties which were encountered in this irrigation are common to nearly all the tract, and serve to emphasize the advantage of grading the land as well as possible before any water is turned into the ditches. Even with perfect grading, some trouble will arise owing to the light nature of the soil in the ditch banks, and it is only after two or three irrigations that these become permanent enough to be left without care when irrigating.

The experiment was carried on for three days, the water being turned on in the morning and shut off in the evening, since there was no one to take charge during the night. It is probable that the experiment took somewhat longer and that evaporation was somewhat increased on this account. During the night the silt in the wet furrows packed to such an extent that when water was again turned into them in the morning it required three or four hours for the water to

penetrate the silt and start the lateral seepage again. After the water had been running for a day or two it became clear and gave no further trouble by silting up the furrows. The soil was somewhat shallow compared with average soil on the tract, and the depth of saturation was only 2.5 to 3 feet. The results of the experiment may be summarized as follows:

Results of experiments on amounts of irrigation water to apply.

Area irrigated	acres	2⅓
Time required	hours	30
Total amount of water which passed through head gate	acre-feet	2.56
Total amount of water passing through waste gate	do	.44
Total amount of moisture absorbed by the land	do	2.12
Depth applied	foot	.91
Length of furrow	feet	560
Time to flow through one furrow	hours	3
Time to seep laterally between furrows	do	20
Depth of saturation	feet	2½–3

EXPERIMENTS WITH DIFFERENT CROPS.

Little is definitely known as to the methods of culture and irrigation best suited to the conditions of this district. For this reason it is believed that the following data, taken from the records of the experiment farm at Twin Falls, through the courtesy of Supt. A. McPherson, and showing the preparation of land for various crops, the time of irrigation, and the yields on this farm during one season, may be of assistance to settlers in the district.

Sugar beets.—After clearing, the ground was plowed to medium depth, harrowed, and leveled, and given a light coating of refuse from the livery barn, consisting of refuse hay, etc., which could hardly be called manure; then plowed a second time, irrigated, and disked. Its subsequent treatment was as follows:

May 20, planted; May 27, plants appear above ground; June 12, blocked out and furrowed; June 14, irrigated 14 hours; June 17, hoed; June 25, irrigated second time after plants coming up; June 28, hoed second time, some of the plants wilting; July 8, irrigated, many plants wilting; July 10, cultivated, a poor stand evident; July 15, irrigated; July 18, plat disked and planted to millet, with the exception of two rows; August 1, two rows irrigated; August 3, cultivated; August 16, cultivated again; October 6, harvested.

Corn (White Flint corn, called "Cassia County").—Soil was prepared for the corn by deep plowing, harrowed, irrigated, disked, and planted May 19 with a seeder; 32 inches between rows, 2 feet apart in the row, and from 3 to 5 kernels in the hill.

May 25, plants begin to appear; May 27, accidentally the waste ditch broke and a portion of the field was flooded; the result was baked soil and weak, yellow, sickly plants, which never recovered or did as well as the balance of the plat, showing conclusively that corn should never be flooded; June 5, a few hills, having missed,

were replanted and the plat cultivated; June 6, cultivated; June 8, hoed close to the hills; June 24, furrowed; June 28, irrigated 12 hours; June 30, cultivated; July 7, cultivated; July 10, furrowed out; July 12, irrigated 9 hours; July 13, cultivated; July 18 to 20, suckered; July 20, placed 18 white cloth strings on ears showing silks; July 23, placed 10 black cloth strings on ears showing silks; August 4, irrigated 10 hours; August 10, cultivated and laid by for the season; August 22, the corn was hard and past any danger from frost; September 10, cut and shocked; October 10, finished husking the corn.

Yield, 40½ bushels per acre. It will readily be seen that corn does not require a great amount of water, being irrigated only three times, aggregating in the season 31 hours.

Wheat (Little Club).—Plowed 8 inches; irrigated; disked.

May 20, planted with a drill, at the rate of 1½ bushels per acre; May 26, plants begin to appear; May 29, furrowed; June 19, irrigated 16 hours; June 30, irrigated 10 hours; July 10, irrigated 10 hours; July 30, irrigated 5 hours; August 10, irrigated 5 hours; August 24, harvested with a self-binder; August 28, stacked; September 7, thrashed.

Yield, 1,235 pounds, or 22.88 bushels per acre. Five irrigations. Total hours irrigated, 46. The last two irrigations were applied for the reason that in leveling the field the surface soil had been scraped off and more frequent irrigations were needed on these spots than elsewhere on the plat.

Wheat (Blue Stem).—Ground prepared the same as for Little Club.

May 20, planted with a drill at the rate of 2 bushels per acre; May 26, plants begin to appear; May 29, furrowed; June 18, irrigated 16 hours; June 30, irrigated 10 hours; July 8, irrigated 8 hours; July 29, irrigated 5 hours; August 10, irrigated 5 hours; August 24, harvested with self-binder; August 28, stacked; September 7, thrashed.

Yield, 1,123 pounds, or 21.8 bushels per acre. Five irrigations. Total hours irrigated, 44.

The last two irrigations were applied for the reason named above. Blue Stem wheat, which was harvested a few days late, shelled out to a greater degree than Little Club. But for this the yield would have been larger.

Hulless barley.—Ground prepared the same as for wheat.

May 20, planted with a drill; May 25, plants begin to appear; May 29, furrowed; June 18, irrigated 20 hours; June 30, irrigated 8 hours; July 18, irrigated by flooding 6 hours; July 31, irrigated by flooding 6 hours; August 18, harvested; August 18, stacked; September 7, thrashed.

Yield, 181 pounds, at the rate of 9½ bushels per acre. Four irrigations. Total hours irrigated, 40.

The barley was planted on a plat where a large part of the surface soil had been scraped off in leveling. It came up stronger and more vigorous than any of the other grains, but when the weather grew very warm it seemed to languish..

Corn Wheat (or Siberian Rye).—Ground prepared the same as for wheat.

May 20, planted with a drill, at the rate of 1 bushel to the acre; May 25, plants began to appear; May 27, furrowed; June 20, irrigated 16 hours; July 5, irrigated 8 hours; July 20, irrigated 8 hours; July 30, irrigated 8 hours; August 18, harvested; August 24, stacked; September 7, thrashed.

Yield 831 pounds, or at the rate of 18 bushels per acre. Four irrigations. Total hours irrigated, 40.

Oats (Big Four).—Ground prepared the same as for wheat.

May 20, planted with drill, at the rate of 6 pecks to the acre; May 25, plants began to appear; May 29, furrowed; June 21, irrigated 24 hours; July 9, irrigated 12 hours; July 30, irrigated 16 hours; August 18, harvested; August 26, stacked; September 7, thrashed.

Yield 1,136 pounds, or at the rate of 35½ bushels per acre. Three irrigations. Total hours irrigated, 52.

Cowpeas (Whip-poor-will).—

May 20, drilled in; May 29, plants began to appear; May 29, furrowed; June 4, a few black aphis began to appear on plants; June 22, irrigated 18 hours; July 10, harrowed; July 20, irrigated by flooding.

Two irrigations. The peas were planted on a plat of ground where a large proportion of the surface soil had been removed in leveling. A poor stand was obtained, excepting where no soil had been removed. September 26 they were plowed under for fertilizer.

Potatoes.—Ground was prepared for planting by deep plowing, harrowed, irrigated, and harrowed again. In planting a large single shovel plow was used, furrowing out the ground 32 inches apart. The seeds were dropped into this furrow, and then covered with a horse hoe.

May 25, harrowed; May 27, harrowed; June 7, harrowed; June 10, all plants above ground and thrifty; June 19, cultivated; June 24, furrowed; June 28, irrigated 12 hours; June 30, cultivated; July 5, cultivated; July 9, furrowed and irrigated 12 hours; July 12, hilled up with a cultivator; July 18 to 20, hilled up; July 19, laid by for the season.

Two irrigations. Total hours irrigated, 24. Production, 19,200 pounds, or 330 bushels per acre.

Millet (Early Fortune).—Ground prepared the same as for wheat and oats.

May 22, sown broadcast at the rate of 20 pounds per acre; May 23, harrowed; May 25, furrowed; May 31, plants began to appear; June 4, irrigated 12 hours; June 27, irrigated 12 hours; July 5, flooded 2 hours (accidental, doing more harm than good); August 4, irrigated 14 hours; August 18, harvested; September 7, thrashed.

Yield, 857 pounds, or at the rate of 1,000 pounds per acre. Four irrigations. Total hours irrigated, 40. Only 10 pounds of seed was sown on this plat, and in thrashing it the machine was not prepared to do the work and a large portion of the seed was lost.

Navy beans.—Ground prepared the same as for wheat and oats.

May 22, planted in rows 3 feet and 10 inches apart and 18 inches apart in row; May 29, plants all up; June 7, cultivated; June 9, hoed; June 24, furrowed; June 30, irrigated 10 hours; July 5, cultivated; July 10, irrigated 15 hours; July 15, cultivated, hoed, and laid by for the season.

Yield, 1½ bushels, at the rate of 12 bushels per acre. This crop was only irrigated twice. Total hours irrigated, 25. One more irrigation would probably have been beneficial.

Henderson Bush Lima.—The record for these beans was essentially the same as for the navy beans, as well as the yield, except that an additional irrigation would not have been beneficial.

Bayle beans.—The same record as above, as far as planting, cultivation, and irrigation are concerned, but the crop was not satisfactory, as a large proportion of it was attacked with bean rust, and the remainder grew very large vines with few pods.

Corn (Iowa Gold Mine).—Soil prepared the same as for other grains.

May 22, planted in rows 3 feet 2 inches apart, 2 feet apart in the row, 3 to 5 kernels in the hill; May 31, plants coming up; June 7, cultivated; June 28, furrowed; June 30, irrigated 12 hours; July 5, cultivated; August 1, irrigated 12 hours; August 10, cultivated; August 24, white cloth strings tied on 18 first ears silk; September 4, cut and shocked for fodder.

It became evident that the corn would not mature, consequently it was cut and sold for fodder. The stalks that had the marked ears on them were left standing until September 24 and were then sufficiently matured for seed. Two irrigations. Total hours irrigated, 24.

Buckwheat.—The first sowing of buckwheat was made June 6. Two kinds were sown, Japanese and Silver Hull.

June 20, irrigated 12 hours; July 10, irrigated 10 hours.

Did not head well and seemed to wilt in the hot sun. Plowed under for fertilizer.

Second sowing of buckwheat, July 17.

July 20, irrigated 12 hours; August 5, irrigated 8 hours; September 4, irrigated 8 hours.

A poor crop; plowed under for fertilizer.

Alfalfa and oats.—This 14½ acres was not plowed. After clearing it of sagebrush it was simply run over with a disk harrow. The oats were drilled in, while the alfalfa was sown broadcast by the same machine.

May 26, planted; May 27, finished furrowing; May 28, began irrigating, and finished the 29th, alfalfa coming up, a good stand in 4 days, and the oats in 5 days; June 7 to 12, irrigated; June 27 to 29, irrigated; June 2 to 4, irrigated; August 7 to 9, irrigated.

In each irrigation water was allowed to run 12 hours, being changed morning and night.

August 24, harvested the oats with self-binder; August 30, stacked; September 7, thrashed oats.

Production 323 bushels, or 23 bushels to the acre. Five irrigations, aggregating 60 hours' continuous flow.

While we got a very good stand of alfalfa, it made a very poor growth, but will doubtless come along all right next year. Except as a makeshift, it is not advisable to plant alfalfa with any other crop. This plat of ground required more frequent irrigations than any other. Less irrigation would have been required and a better crop grown had the ground been plowed before planting.

Clover.—Land plowed medium depth, harrowed, and irrigated.

May 26, 14 pounds of seed was sown broadcast to the acre and harrowed in; June 1, plants appeared, coming up in 5 days; June 2 to 3, irrigated 12 hours; June 20 to 22, irrigated 8 hours; July 10 to 12, irrigated 10 hours; August 10, irrigated 12 hours; September 2, harvested ¼ ton per acre.

Four irrigations, aggregating 42 hours. The clover made a very satisfactory growth, having a fine color and tubercles on the roots.

Timothy and clover.—Ground prepared by plowing deeply, irrigated, harrowed, and on—

May 26, sown broadcast, 6 pounds timothy and 8 pounds clover per acre; May 27, furrowed; June 10, irrigated 12 hours; June 29, irrigated 10 hours; July 12, irrigated 8 hours; August 8, irrigated 8 hours; August 12, harvested.

Yield ¼ ton per acre. Four irrigations in a total of 38 hours. We obtained a very fine stand.

Alfalfa and orchard grass.—Ground prepared the same as for wheat.

May 26, seeded broadcast with seeder and harrowed in; 8 pounds of alfalfa and 12½ pounds of orchard grass per acre; May 31, furrowed; June 11, irrigated 12 hours; June 30, irrigated 6 hours; July 15, irrigated 10 hours; August 5, irrigated 6 hours; August 10, harvested, production at the rate of about ¼ ton per acre; August 31, irrigated 12 hours; September 25, harvested.

Yield at the rate of about ⅜ ton per acre. Five irrigations. Hours irrigated, 46.

Flax.—Ground prepared the same as for wheat.

May 25, planted with a drill at the rate of ½ bushel per acre; June 10, furrowed and irrigated 12 hours; July 1, irrigated 12 hours.

The flax then began to wilt badly on account of the warm weather.

July 15, this plat was run over with a disk harrow and replanted to German millet.

Millet.—

July 15, planted; July 20, irrigated 10 hours; August 1, irrigated 19 hours.

Yield 1,000 pounds per acre.

Millet (Hungarian).—This millet was planted on the plat that had been in sugar beets and gave the same results as German millet.

The furrow system of irrigation was practiced in nearly all cases on the farm. All of the ground except the 14½ acres seeded to alfalfa and oats was plowed and irrigated and then run over with the disk harrow before planting. Less irrigation was required during the growing season, and a much better crop was produced than where the land had not been plowed. The water used was not measured, but was the amount thought necessary for the best results. It is hoped in 1906 to measure all the water used on the farm and to demonstrate whether 1 cubic foot per second for each 80 acres, if properly managed, is ample.

Nearly all the small grains sown on the tract in 1905 were planted at least a month and in some cases two months out of season. Even when planted in season the yield was reduced a great deal by unskilled irrigation and new land. When once the soil has been properly supplied with humus and the science of irrigation is better understood small grains should be among the most profitable crops.

CONCLUSION.

The future prosperity of the Snake River plains seems assured when the conditions affecting them are considered. A soil rich in all the constituents of a fertile soil, except humus, which, however, can be supplied by a proper system of cropping; an ample supply of water, and a favorable climate, seem to assure a regular and heavy crop. The topography of the country is such as to insure good drainage, and thus to guard against a rise of alkali, a cause of more damage to irrigated communities than all others combined. The high duty assumed under the larger systems in selling water rights will tend to bring into use the most scientific and skillful methods of irrigation, as well as prevent the ruining of the land by overirrigation.

The chief problem for the Twin Falls tract will be the question of markets for products. The demand among neighboring towns will take only a small portion of the total yield, and the bulk of it must be fed to stock or shipped. All of the larger cities in Idaho and the adjoining States are supplied by irrigated districts immediately surrounding them. Consequently the market for crops other than hay and grain will be a distant one, and the bulk of the products must be in such a form as to warrant shipping long distances at a profit. Judging by the amount of land being planted to orchard, the number of dairy cattle being shipped into the country, and the future plans of a majority of the settlers on the tract, these products will be fruit, dairy products, and sugar beets.

Recommended for publication.

A. C. True, *Director.*

Publication authorized.

James Wilson, *Secretary of Agriculture.*

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